

REMARKS

INTRODUCTION:

In accordance with the foregoing, claims 59-63 have been added, and claims 1, 4, 7, 10, 18, 23, 26, 27, 29, 30, 34, 36, 40, 41, 44, 46, 49, 53, and 55 and the specification have been amended in accordance with 37 CFR §1.173 relative to the issued patent, U.S. Patent No. 5,805,334, and claims 28, 35, and 51 have been cancelled without prejudice or disclaimer. Support for the changes in claims 1, 4, 7, 10, 18, 23, 26, 27, 29, 30, 34, 36, 40, 41, 44, 46, 49, 53, and 55 and for new claims 59-63 is found in, among other embodiments of the invention, the embodiment shown in FIG. 5 and described in col. 8, line 62 to col. 9, line 22, in which a reticle R and a wafer W are disposed in parallel planes.

In reviewing the reissue application as filed, it appears that typographical errors were accidentally introduced into claims 1, 4, 7, 10, 18, 23 and 26 and the specification at the filing of the instant reissue application. However, the typographical errors were not present in claims 1, 4, 7, 10, 18, 23 and 26 and the specification when claims 1, 4, 7, 10, 18, 23 and 26 and the specification issued in U.S. Patent No. 5,805,334. As such, an amendment is made as to claims 1, 4, 7, 10, 18, 23 and 26 and the specification to remove the typographical errors so as to return the claims to their issued form.

Further, depending claims 29, 30, and 36 have been amended to correct their dependencies in light of the cancellation of claims 28 and 35, which were cancelled without prejudice or disclaimer.

No new matter is being presented, and approval and entry of the foregoing new claims and amendments are respectfully requested.

Claims 1-50 and 52-63 are pending and under consideration. Reconsideration is requested.

REJECTION UNDER 35 U.S.C. §102:

In the Office Action at pages 2-5, the Examiner rejects claims 27-30, 32-35, 37, 39-42, 44-47, 49, 50, 52, 54, 56, and 57 under 35 U.S.C. §102 in view of Schoenmakers (U.S. Patent No. 5,323,263). This rejection is respectfully traversed and reconsideration is requested.

By way of review, claim 27 recites, among other features, "a catadioptric imaging optical sub-system comprising an optical group to form an image of the pattern, the optical group comprising a concave mirror with a first optical axis," a dioptric imaging sub-system "comprising a second optical axis," where "the first optical axis and the second optical axis are not parallel to each other, the first plane and the second plane are arranged to be parallel to each other, the

optical group of said catadioptric imaging optical sub-system comprises a first optical subgroup comprising a third optical axis, and a second optical subgroup comprising the concave mirror and the first optical axis, and the second and third axes form a straight optical axis."

In contrast, Schoenmakers discloses lens groups 20, 30, 50 and a concave mirror 40 that form an image at an image region 90 of an object at an object plane 12. Schoenmakers further discloses lens groups 60, 80 and a concave mirror 70 that forms an image at an image plane 15 of the image at the image region 90. (Col. 3, lines 29-41; FIG. 1). Even assuming arguendo that the lens groups 60, 80 and the concave mirror 70 could be characterized as a dioptric imaging system to correspond with the dioptric imaging sub-system recited in claim 27, it is noted that an optical axis for the lens group 20 is not in common with the optical axis for the lens group 80. As such, it is respectfully submitted that, consistent with the Examiner's statement on page 7 in regards to claim 51, Schoenmakers does not disclose or suggest at least "the second and third axes form a straight optical axis" as recited in claim 27.

For at least similar reasons, it is respectfully submitted that Schoenmakers does not disclose or suggest the invention recited in claims 40, 41, and 44.

In addition, while Schoenmakers discloses flat folding mirrors 85 and 87, it is apparent from FIG. 1 that the surfaces of the mirrors 85 and 87 are parallel. As such, even assuming arguendo that the lens groups 60, 80 and the concave mirror 70 disclosed in Schoenmakers could be characterized as a dioptric imaging optical system to correspond with the dioptric imaging optical sub-system recited in claim 46, it is respectfully submitted that Schoenmakers does not disclose or suggest that "a first reflection surface of the first turning mirror and a second reflection surface of the second turning mirror are arranged to be non-parallel with each other" as recited in claim 46.

For at least similar reasons, it is respectfully submitted that Schoenmakers does not disclose or suggest the invention recited in claim 49.

Claims 28-30, 32-35, 37, 39, 42, 45, 47, 50, 52, 54, 56, and 57 are deemed patentable due at least to their depending from corresponding claims 27, 41, 44, 46, and 49.

REJECTION UNDER 35 U.S.C. §103:

In the Office Action at page 5, the Examiner rejects claims 38, 43, and 48 under 35 U.S.C. §103 in view of Schoenmakers and statements in the instant specification at col. 10, lines 37-41. The rejection is respectfully traversed and reconsideration is requested.

Even assuming arguendo that the statements in the instant specification at col. 10, lines 37-41 are considered prior art usable against the instant application, the statements are not

relied upon as curing and do not cure the above noted deficiencies of Schoenmakers as applied to claims 37, 42, and 47, from which claims 38, 43, and 48 correspondingly depend. As such, it is respectfully submitted that the combination of Schoenmakers and statements in the instant specification at col. 10, lines 37-41, do not disclose or suggest the invention recited in claims 38, 43, and 48 due at least to the combination not disclosing or suggesting the invention recited in claims 37, 42, and 47.

STATUS OF CLAIMS NOT REJECTED:

In the Office Action at pages 5-6, the Examiner allows claims 1-26 and 58, and objects to claims 31, 36, 51, 53, and 55 for depending from corresponding claims. Claim 51 has been cancelled without prejudice or disclaimer. Therefore the objection to claim 51 is deemed moot.

Further, claims 53 and 55 have been made independent, and have further been amended to recite first and second planes and to at least replace the term "said" with "the" as indicated without narrowing the scope of the claims. As such, it is respectfully requested that the Examiner reconsider the rejection of claims 53 and 55.

PATENTABILITY OF NEW CLAIMS:

Claim 59 generally corresponds to objected to claim 31, as filed with the reissue application. Claim 63 generally corresponds to claim 36, as filed with the reissue application. Therefore, it is respectfully submitted that claims 59 and 63 are deemed patentable for at least reasons set forth by the Examiner on page 6 of the Office Action in relation to claims 31 and 36.

It is respectfully submitted that claim 60 is deemed patentable due at least to the prior art not disclosing or suggesting, among other features, that "the third optical axis and the second optical axis intersect" consistent with the Examiner's statement on page 6 of the Office Action in relation to claim 36.

It is respectfully submitted that claim 61 is deemed patentable due at least to the prior art not disclosing or suggesting, among other features, that "the dioptric imaging sub-system comprises an aperture stop" consistent with the Examiner's statement on page 6 of the Office Action in relation to claim 31.

It is respectfully submitted that claim 62 is deemed patentable due at least to the prior art not disclosing or suggesting, among other features, that "the third optical axis and the second optical axis intersect" consistent with the Examiner's statement on page 6 of the Office Action in relation to claim 36.

ATTACHMENT SHOWING AMENDMENTS:

While not required under 37 CFR §1.173, please find enclosed a Version With Markings To Show Changes Made, which is provided for the convenience of the Examiner. The changes are relative to the reissue application, as filed.

CONCLUSION:

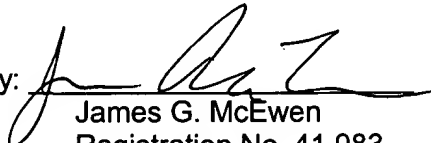
In accordance with the foregoing, it is respectfully submitted that all outstanding objections and rejections have been overcome and/or rendered moot. And further, it is respectfully submitted that all pending claims patentably distinguish over the prior art. Thus, there being no further outstanding objections or rejections, the application is submitted as being in condition for allowance which action is earnestly solicited.

If the Examiner has any remaining issues to be addressed, it is believed that prosecution can be expedited by the Examiner contacting the undersigned attorney for a telephone interview to discuss resolution of such issues.

If there are any additional fees associated with the filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please **CANCEL** claims 29, 35, and 51 without prejudice or disclaimer, **REPLACE** claims 1, 4, 7, 10, 18, 23, 26, 27, 29, 30, 34, 36, 40, 41, 44, 46, 49, 53, and 55, and **ADD** claims 59-63, as follows:

1. (ONCE AMENDED) A catadioptric projection system for receiving light from a reticle and projecting a pattern from the reticle onto a substrate, the catadioptric projection system comprising:

a first imaging system that forms an intermediate image of an illuminated region of the reticle, the first imaging system comprising in order from the reticle and along an optical axis of the first imaging system, (a) a single-pass lens group comprising a first negative subgroup, a positive subgroup, and a second negative subgroup, and (b) a double-pass lens group comprising a concave mirror, wherein light from the illuminated region of the reticle passes through the single-pass lens group and the double-pass lens group, reflects from the concave mirror, and returns through the double-pass optical group;

a first turning mirror placed near the intermediate image that receives the light reflected by the concave mirror [to] and returned through the double-pass optical group; and

a second imaging system that receives the light reflected by the first turning mirror and that re-images the intermediate image to form a final image of the illuminated region of the reticle on the substrate.

4. (ONCE AMENDED) The catadioptric projection system of claim 2, wherein the second negative subgroup of the single-pass lens group comprises a lens [element] element with a concave surface facing the double-pass lens group.

7. (ONCE AMENDED) The catadioptric projection system of claim 1, further comprising a third turning mirror placed between the single-pass lens group and the double-pass lens group and that receives light from the single-pass lens group and directs the light to the double-pass lens group.

10. (ONCE AMENDED) A catadioptric projection system for receiving light [so] from a reticle and projecting a pattern from the reticle onto a substrate, the catadioptric projection system comprising:

a first imaging system that forms an intermediate image of an illuminated region of the reticle, the first imaging system comprising from objectwise to [imagewise] imagewise, (a) a single-pass lens group comprising a first negative subgroup, a positive subgroup, and a second negative subgroup, and (b) a double-pass lens group comprising a concave mirror, wherein light from the illuminated region of the reticle passes through the single-pass lens group and the double-pass lens group, reflects from the concave mirror, and returns through the double-pass lens group;

a first turning mirror placed near the intermediate image, the first turning mirror separating the light propagating from the double-pass lens group from the light propagating to the double-pass lens group; and

a second imaging system that receives the light reflected by the concave mirror and reflected back through the double-pass lens group and that re-images the intermediate image to form a final image of the illuminated region of the reticle on the substrate.

18. (ONCE AMENDED) A method for projecting a pattern from a reticle onto a substrate, comprising the steps of:

(a) providing a first imaging system comprising a single-pass lens group including from objectwise to imagewise, a first negative lens subgroup, a positive lens subgroup, and a second negative lens subgroup; and a double-pass lens group comprising a concave mirror;

(b) transmitting light from the reticle through the single-pass lens group and the double-pass lens group to the concave mirror, and returning the light reflected from the concave mirror back through the double-pass lens group toward the single-pass lens group;

(c) separating the light propagating through the double-pass lens group to the concave mirror from the light propagating through the double-pass lens group from the concave mirror;

(d) with the first imaging system, forming an intermediate image of the pattern between the first imaging system and the second imaging system;

(e) directing the light propagating from the concave mirror through the second imaging system; and

(f) forming an image of the reticle on the substrate with the second imaging system.

23. (ONCE AMENDED) The method of claim 18, further comprising:

providing a first turning mirror placed between the single-pass lens group and the double-pass lens group; and

directing light, returning through the double-pass lens group from the concave mirror, to the second imaging system using the first turning mirror.

26. (ONCE AMENDED) An exposure system for projecting patterns on a reticle onto a substrate, the system comprising:

(a) a catadioptric projection system that receives an illumination flux from an illuminated region on the reticle and forms an image of the illuminated region on the reticle on a corresponding region on the substrate;

(b) the catadioptric projection system comprising a first imaging system and a second imaging system, the first imaging system forming an intermediate image of the illuminated region of the reticle, and the second imaging system serving to re-image the intermediate image to form an image of the illuminated region of the reticle on the corresponding region of the substrate;

(c) the first imaging system comprising from objectwise to imagewise, (i) a single-pass lens group comprising a first negative subgroup, a positive subgroup, and a second negative subgroup; and (ii) a double-pass lens group comprising a concave mirror, wherein light from the illuminated region of the reticle passes through the single-pass lens group and the double-pass lens group, reflects from the concave mirror, and returns through the double-pass lens group;

(d) a first turning mirror situated near the intermediate image, the first turning mirror separating the light propagating from the double-pass lens group from the light propagating to the double-pass lens group; and

(e) a reticle scanner and a substrate scanner for respectively scanning the reticle and substrate synchronously to allow the [caladioptric] catadioptric projection system to project the patterns on the reticle onto the substrate.

27. (ONCE AMENDED) A catadioptric imaging optical system in a projection exposure apparatus that transfers a pattern on a reticle which is arranged in a first plane onto a substrate which is arranged in a second plane, [said] the system comprising:

a catadioptric imaging optical sub-system comprising an optical group to form an image of the pattern, the optical group comprising a concave mirror with a first optical axis; and

a dioptric imaging sub-system arranged in an optical path between [said] the catadioptric imaging optical sub-system and the [substrate] second plane to re-image the image formed by [said] the catadioptric imaging optical sub-system, [said] the dioptric imaging sub-system comprising a second optical axis,

wherein

the first optical axis and the second optical axis are not parallel to each other,
[and]

the [reticle] first plane and the [substrate] second plane are arranged to be parallel to each other,

the optical group of said catadioptric imaging optical sub-system comprises a first optical subgroup comprising a third optical axis, and a second optical subgroup comprising the concave mirror and the first optical axis, and

the second and third axes form a straight optical axis.

28. (CANCELLED)

29. (ONCE AMENDED) A catadioptric imaging optical system according to claim [28] 27, wherein the third optical axis and the second optical axis are parallel to each other.

30. (ONCE AMENDED) A catadioptric imaging optical system according to claim [28] 27, wherein the second optical subgroup comprises a negative lens and a positive lens.

34. (ONCE AMENDED) A catadioptric imaging optical system according to claim 33, further comprising a second turning mirror arranged in an optical path between the concave mirror and the [reticle] first plane.

35. (CANCELLED)

36. (ONCE AMENDED) A catadioptric imaging optical system according to claim [35] 34, wherein the third optical axis and the second optical axis intersect.

40. (ONCE AMENDED) A method of imaging a pattern on a reticle which is arranged in a first plane onto a substrate which is arranged in a second plane, comprising:

forming an intermediate image of the pattern on the reticle using a catadioptric imaging optical sub-system, wherein the catadioptric imaging optical sub-system comprises an optical group comprising a concave mirror with a first optical axis; and

re-imaging the intermediate image formed by the catadioptric imaging optical sub-system onto the substrate using a dioptric imaging sub-system arranged in an optical path between the catadioptric imaging optical sub-system and the [substrate] second plane, wherein the dioptric imaging sub-system comprises a second optical axis,

wherein

the first optical axis and the second optical axis intersect, [and]

the first plane [reticle] and the second plane [substrate] are arranged to be parallel to each other,

the optical group of said catadioptric imaging optical sub-system comprises a first optical subgroup comprising a third optical axis, and a second optical subgroup comprising the concave mirror and the first optical axis, and

the second and third optical axes form a straight optical axis.

41. (ONCE AMENDED) A catadioptric imaging optical system used in a projection exposure apparatus that transfers a pattern on a reticle which is arranged in a first plane onto a substrate which is arranged in a second plane, comprising:

a catadioptric imaging optical sub-system in an optical path between the [reticle] first plane and the [substrate] second plane, [said] the catadioptric imaging optical sub-system comprising

a first optical group with a lens with a first optical axis, and

a second optical group with a concave mirror with a second optical axis; and

a dioptric imaging sub-system with a third optical axis arranged in an optical path between said catadioptric imaging optical sub-system and said substrate,

wherein

the first optical axis and second optical axis intersect, [and]

[wherein] the second optical axis and the third optical axis intersect, and

the first and third optical axes form a straight optical axis.

44. (ONCE AMENDED) A method of imaging a pattern on a reticle onto a substrate, comprising:

passing a light from the reticle through a first optical group comprising a lens with a first optical axis;

forming an intermediate image by a light passing through the first optical group and a second optical group, the second optical group comprising a concave mirror with a second optical axis; and

guiding a light having passes through the second optical group to the substrate by passing the light through a dioptric imaging optical sub-system with a third optical axis, wherein

the first optical axis and the second optical axis intersect, [and]
[wherein] the second optical axis and the third optical axis intersect, and
the first and third optical axes form a straight optical axis.

46. (ONCE AMENDED) A catadioptric imaging optical system used in a projection exposure apparatus that transfers a pattern on a reticle which is arranged in a first plane onto a substrate which is arranged in a second plane, comprising:

a first turning mirror arranged in an optical path between the [reticle] first plane and the [substrate] second plane;

a concave mirror arranged in an optical path between [said] the first turning mirror and the [substrate] second plane;

a second turning mirror arranged in an optical path between [said] the concave mirror and the [substrate] second plane; and

a dioptric imaging optical sub-system arranged in an optical path between [said] the second turning mirror and the [substrate] second plane and comprising an optical axis,

wherein

the [reticle] first plane and the [substrate] second plane are arranged to be parallel to each other, and

a first reflection surface of the first turning mirror and a second reflection surface of the second turning mirror are arranged to be non-parallel with each other.

49. (ONCE AMENDED) A method of imaging a pattern on a reticle which is arranged in a first plane onto a substrate which is arranged in a second plane, comprising:

reflecting a light from the reticle with a first reflection surface of a first turning mirror;

reflecting the light from the first turning mirror with a concave mirror;

reflecting the light from the concave mirror using a second reflection surface of a second turning mirror; [and]

passing the light from the second turning mirror to the substrate through a dioptric imaging optical sub-system having an optical axis[.];

[wherein] forming an intermediate image of the pattern [is formed] in an optical path between the concave mirror and the dioptric imaging optical sub-system;[,] and

forming an image of the intermediate image [is formed] on the substrate by the dioptric imaging optical sub-system, [and]

wherein

the [reticle] first plane and [said substrate] the second plane are arranged in parallel to each other, and

the first and second reflection surfaces are arranged to be non-parallel with each other.

51. (CANCELLED)

53. (ONCE AMENDED) A catadioptric imaging optical system used in a projection exposure apparatus that transfers a pattern on a reticle which is arranged in a first plane onto a substrate which is arranged in a second plane, comprising:

a catadioptric imaging optical sub-system in an optical path between the first plane and the second plane, the catadioptric imaging optical sub-system comprising

a first optical group with a lens with a first optical axis, and

a second optical group with a concave mirror with a second optical axis; and

a dioptric imaging sub-system with a third optical axis arranged in an optical path between the catadioptric imaging optical sub-system and the second plane,

wherein

the first optical axis and second optical axis intersect, and

the second optical axis and the third optical axis intersect

the first and third optical axes are parallel to each other, and

the first and third optical axes form a straight optical axis.

55. (ONCE AMENDED) A method of imaging a pattern on a reticle onto a substrate, comprising:

passing a light from the reticle through a first optical group comprising a lens with a first optical axis;

forming an intermediate image by a light passing through the first optical group and a second optical group, the second optical group comprising a concave mirror with a second optical axis; and

guiding a light having passes through the second optical group to the substrate by passing the light through a dioptric imaging optical sub-system with a third optical axis,

wherein

the first optical axis and the second optical axis intersect, and

the second optical axis and the third optical axis intersect.

the first and third optical axes are parallel to each other, and

the first and third optical axes form a straight optical axis.

59. (NEW) A catadioptric imaging optical system in a projection exposure apparatus that transfers a pattern on a reticle which is arranged in a first plane onto a substrate which is arranged in a second plane, the system comprising:

a catadioptric imaging optical sub-system comprising an optical group to form an image of the pattern, the optical group comprising a concave mirror with a first optical axis; and

a dioptric imaging sub-system arranged in an optical path between the catadioptric imaging optical sub-system and the second plane to re-image the image formed by the catadioptric imaging optical sub-system, the dioptric imaging sub-system comprising a second optical axis,

wherein

the first optical axis and the second optical axis are not parallel to each other,

the first plane and the second plane are arranged to be parallel to each other, and

the dioptric imaging optical sub-system further comprises an aperture stop.

60. (NEW) A catadioptric imaging optical system in a projection exposure apparatus that transfers a pattern on a reticle which is arranged in a first plane onto a substrate which is arranged in a second plane, the system comprising:

a catadioptric imaging optical sub-system comprising an optical group to form an image of the pattern, the optical group comprising a concave mirror with a first optical axis; and

a dioptric imaging sub-system arranged in an optical path between the catadioptric imaging optical sub-system and the second plane to re-image the image formed by the catadioptric imaging optical sub-system, the dioptric imaging sub-system comprising a second optical axis;

wherein

the first optical axis and the second optical axis are not parallel to each other,
the first plane and the second plane are arranged to be parallel to each other,
the optical group of said catadioptric imaging optical sub-system comprises:

a first subgroup comprising a third optical axis, and

a second subgroup comprising the concave mirror and the first optical

axis, and

the third optical axis and the second optical axis intersect.

61. (NEW) A method of imaging a pattern on a reticle which is arranged in a first plane onto a substrate which is arranged in a second plane, comprising:

forming an intermediate image of the pattern on the reticle using a catadioptric imaging optical sub-system, the catadioptric imaging optical sub-system comprising an optical group comprising a concave mirror and a first optical axis; and

re-imaging the intermediate image formed by the catadioptric imaging optical sub-system onto the substrate using a dioptric imaging sub-system arranged in an optical path between the catadioptric imaging optical sub-system and the second plane, the dioptric imaging sub-system comprising a second optical axis,

wherein

the first optical axis and the second optical axis intersect,

the first plane and the second plane are arranged to be parallel with each other,

and

the dioptric imaging sub-system comprises an aperture stop.

62. (NEW) A method of imaging a pattern on a reticle which is arranged in a first plane onto a substrate which is arranged in a second plane, comprising:

forming an intermediate image of the pattern on the reticle using a catadioptric imaging optical sub-system, the catadioptric imaging optical sub-system comprising an optical group comprising a concave mirror and a first optical axis; and

re-imaging the intermediate image formed by the catadioptric imaging optical sub-system onto the substrate using a dioptric imaging sub-system arranged in an optical path between the catadioptric imaging optical sub-system and the second plane, the dioptric imaging sub-system comprising a second optical axis,

wherein

the first optical axis and the second optical axis intersect,
the first plane and the second plane are arranged to be parallel with each other,
and

the optical group of the catadioptric imaging optical sub-system comprises a first subgroup comprising a third optical axis, and a second subgroup comprising the concave mirror and the first optical axis, and

the third optical axis and the second optical axis intersect.

63. (NEW) A catadioptric imaging optical system in a projection exposure apparatus that transfers a pattern on a reticle which is arranged in a first plane onto a substrate which is arranged in a second plane, the system comprising:

a catadioptric imaging optical sub-system comprising an optical group to form an image of the pattern, the optical group comprising a concave mirror with a first optical axis;

a dioptric imaging sub-system arranged in an optical path between the catadioptric imaging optical sub-system and the second plane to re-image the image formed by the catadioptric imaging optical sub-system, the dioptric imaging sub-system comprising a second optical axis;

a first turning mirror arranged in an optical path between the concave mirror and the dioptric imaging optical sub-system; and

a second turning mirror arranged in an optical path between the concave mirror and the first plane,

wherein

the first optical axis and the second optical axis are not parallel to each other,

the reticle and the substrate are arranged to be parallel to each other,

the optical group of said catadioptric imaging optical sub-system comprises:

a first subgroup comprising a third optical axis, and

a second subgroup comprising the concave mirror and the first optical

axis; and

the third optical axis and the second optical axis intersect.